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SOLUTION BY W. E. HEAL, WHEELING, INDIANA.

Let the indefinite integral

$$\int dx \left[ 1 + \left( \frac{dy}{dx} \right)^2 \right]^{\frac{1}{2}} = \varphi(x), \text{ then } \int_0^x dx \left[ 1 + \left( \frac{dy}{dx} \right)^2 \right]^{\frac{1}{2}} = \varphi(x) - \varphi(0) = \frac{ny}{x}$$

Differentiating the above eq'n, (1), remembering that  $\varphi(0)$  is constant,

$$dx \sqrt{1 + \left( \frac{dy}{dx} \right)^2} = \frac{n(xdy - ydx)}{x^2}. \quad (2)$$

Put  $dy \div dx = p$ , and (2) becomes  $x^2 \sqrt{1 + p^2} = npy - ny$ . (3)

Differentiating (3) we have

$$\frac{xpd p}{\sqrt{1 + p^2}} + 2dx \sqrt{1 + p^2} = ndp. \quad (4)$$

Divide by  $2(1 + p^2)^{\frac{1}{2}}$ ;  $dx(1 + p^2)^{\frac{1}{2}} + xpd p \div (1 + p^2)^{\frac{1}{2}} = ndp \div 2(1 + p^2)^{\frac{1}{2}}$ . (5)

Integrating (5) and determining the constant  $C = 0$ , we have

$$x(1 + p^2)^{\frac{1}{2}} = \frac{n}{2} \int \frac{dp}{(1 + p^2)^{\frac{1}{2}}}, \quad (6). \quad \text{Let } p = \frac{2^{\frac{1}{2}}v(1 - \frac{1}{2}v^2)^{\frac{1}{2}}}{1 - v^2}, \text{ then (6) becomes}$$

$$\begin{aligned} \frac{x}{(1 - v^2)^{\frac{1}{2}}} &= \frac{n}{2^{\frac{1}{2}}} \int \frac{dv}{\sqrt{[(1 - v^2)^3(1 - \frac{1}{2}v^2)]}} = 2^{\frac{1}{2}}n \left[ \frac{v(1 - \frac{1}{2}v^2)^{\frac{1}{2}}}{(1 - v^2)^{\frac{1}{2}}} \right. \\ &+ \frac{1}{2} \int \frac{dv}{(1 - v^2)^{\frac{1}{2}}(1 - \frac{1}{2}v^2)^{\frac{1}{2}}} - \left. \int \frac{(1 - \frac{1}{2}v^2)^{\frac{1}{2}}dv}{(1 - v^2)^{\frac{1}{2}}} \right] = 2^{\frac{1}{2}}n \left[ \frac{v(1 - \frac{1}{2}v^2)^{\frac{1}{2}}}{(1 - v^2)^{\frac{1}{2}}} + \frac{1}{2}F(\frac{1}{2}2^{\frac{1}{2}}, v) \right. \\ &- \left. E(\frac{1}{2}2^{\frac{1}{2}}, v) \right] \quad (7), \text{ where } F \text{ and } E \text{ are elliptic funct's of the 1st and 2nd ord's.} \end{aligned}$$

But  $v = \frac{[(1 + p^2)^{\frac{1}{2}} - 1]^{\frac{1}{2}}}{(1 + p^2)^{\frac{1}{2}}}$ , and from (3)  $p = \frac{n^2y + x[n^2(x^2 + y^2) - x^4]}{x(n^2 - x^2)}$ .

Substituting these values in (7) we have the equation of the curve.

[The solution of 306, by Prof. Johnson, of 307, by Prof. Seitz, and of 308, by Mr. Adcock, will be published in No. 4.]

### PROBLEMS.

309. *By Prof. Beman.*—In a given circle, find the vertices of the inscribed square, pentagon, octagon, and decagon by using the dividers alone.

310. *By Prof. Edmunds.*—Required the locus of vertices of a right angled spherical triangle whose legs pass through two fixed points given on the surface of the sphere.

311. *By Prof. Casey.*—A uniform circular plate is placed with its centre upon a prop, to find at what points on its circumference three given weights  $p, q, r$  must be attached that it may remain at rest in a horizontal position.

312. *By Prof. Scheffer.*—To find the area of the loop of the curve  $y^3 + x^2y - axy + bx^2 = 0$ .